

1 A machine for slitting a metal sheet comprising:

2 a frame;

3 an upper drive shaft assembly mounted for rotation in the frame;

4 a lower drive shaft assembly mounted for rotation in the frame;

5 a drive motor operably coupled to the upper and the lower drive

6 shaft assemblies for rotation of the drive shaft assemblies;

7 a plurality of knife holder assemblies supported by the frame in

8 pairs for movement along the drive shaft assemblies such that a first knife

9 holder assembly is supported for movement along the upper drive shaft

10 assembly and a second knife holder assembly is supported for movement

11 along the lower drive shaft assembly;

12 a plurality of rotary knives each being mounted in one of the knife

13 holder assemblies and driven by one of the upper and lower drive shaft

14 assemblies;

15 wherein the knives of the first and second knife holder assemblies

16 cooperate to slit the metal sheet passing through a nip between the knives of

17 the respective knife holder assemblies;

18 a knife holder position adjustment system operably coupled to

19 each of the knife holder assemblies for movement of the knife holder assembly

20 along the respective drive shaft assembly; and

21 a programmable controller operably coupled to the knife holder

22 position adjustment system to position the knife holder assemblies along the

23 respective drive shaft assemblies.

2. The machine of claim 1 wherein the frame further comprises:
 - an upper frame in which the upper drive shaft assembly is rotatably mounted; and
 - a lower frame coupled to the upper frame and in which the lower drive shaft assembly is rotatably mounted.
3. The machine of claim 1 wherein the knife holder position adjustment system further comprises:
 - an upper threaded shaft mounted in the frame; and
 - a lower threaded shaft mounted in the frame;
- 5 wherein each of the knife holder assemblies are threadably coupled to one of the threaded shafts such that rotation of at least a portion of each knife holder assembly relative to the associated threaded shaft moves the knife holder assembly along the associated drive shaft assembly.

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4. The machine of claim 3 wherein the knife holder position adjustment system further comprises:

a plurality of positioning motors each being mounted to one of the knife holder assemblies and operably coupled to the programmable controller;

5 and

a plurality of ball nuts each being mounted to one of the knife holder assemblies, threadably coupled to one of the threaded shafts and operatively coupled to the associated positioning motor;

10 wherein actuation of each positioning motor by the programmable controller rotates the associated ball nut for movement of the associated knife holder assembly along the associated drive shaft assembly.

5. The machine of claim 1 wherein a position of each of the knife holder assemblies is adjustable by the knife holder position adjustment system independent from each of the other knife holder assemblies.

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6. A machine for slitting a metal sheet comprising:

an upper frame;

a lower frame coupled to the upper frame;

an upper drive shaft assembly mounted for rotation in the upper

5 frame;

a lower drive shaft assembly mounted for rotation in the lower

frame;

a drive motor operably coupled to the upper and the lower drive

shaft assemblies for rotation of the drive shaft assemblies;

10 a plurality of knife holder assemblies supported by the upper and

lower frames in pairs for movement along the drive shaft assemblies such that

a first knife holder assembly is supported for movement along the upper drive

shaft assembly and a second knife holder assembly is supported for movement

along the lower drive shaft assembly;

15 a plurality of rotary knives each being mounted in one of the knife

holder assemblies and driven by one of the upper and lower drive shaft

assemblies;

wherein the knives of the first and second knife holder assemblies

cooperate to slit the metal sheet passing through a nip between the knives of

20 the respective knife holder assemblies;

a plurality of positioning motors each being mounted to one of the

knife holder assemblies;

an upper threaded shaft mounted in the upper frame;

a lower threaded shaft mounted in the lower frame;

a plurality of ball nuts each being mounted to one of the knife holder assemblies, threadably coupled to one of the threaded shafts and operatively coupled to the associated positioning motor;

5 wherein rotation of at least a portion of each ball nut relative to the associated threaded shaft moves the knife holder assembly along the associated drive shaft assembly;

a programmable controller operably coupled to each of the positioning motors to position the knife holder assemblies along the respective drive shaft assemblies;

10 wherein actuation of each positioning motor by the programmable controller rotates the associated ball nut for movement of the associated knife holder assembly along the associated drive shaft assembly; and

wherein a position of each of the knife holder assemblies is adjustable independent from each of the other knife holder assemblies.

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7. A machine for slitting a metal sheet comprising:
a frame;
an upper drive shaft assembly mounted for rotation in the frame;
a lower drive shaft assembly mounted for rotation in the frame;
5 each of the drive shaft assemblies comprising a plurality of drive
shaft sections each being coupled to an adjacent drive shaft section for rotation
in the frame;
a drive motor operably coupled to the upper and the lower drive
shaft assemblies for rotation of the drive shaft assemblies;
10 a plurality of knife holder assemblies supported by the frame in
pairs for movement along the drive shaft assemblies such that a first knife
holder assembly is supported for movement along the upper drive shaft
assembly and a second knife holder assembly is supported for movement
along the lower drive shaft assembly; and
15 a plurality of rotary knives each being mounted in one of the knife
holder assemblies and driven by one of the upper and lower drive shaft
assemblies;
wherein the knives of the first and second knife holder assemblies
cooperate to slit the metal sheet passing through a nip between the knives of
20 the respective knife holder assemblies;
wherein the adjacent drive shaft sections of each drive shaft
assembly are adapted to be selectively repositioned relative to one another for
servicing the machine.

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8. The machine of claim 7 further comprising:
a coupling mechanism releasably coupling the adjacent drive shaft sections together.
9. The machine of claim 8 wherein the coupling mechanism is a coupling, each drive shaft section further comprising:
a spindle projecting axially from the drive shaft section, the coupling releasably connecting the spindles on adjacent drive shaft sections.
10. The machine of claim 7 further comprising:
a drive shaft uncoupling mechanism for a user to selectively uncouple the adjacent drive shaft sections.
11. The machine of claim 10 wherein the drive shaft uncoupling mechanism further comprises:
a screw operably coupled to at least one of the drive shaft sections;
- 5 whereupon rotation of the screw axially withdraws the drive shaft section from the adjacent drive shaft section.

12. The machine of claim 7 wherein the adjacent drive shaft sections are uncoupled from one another for servicing of one of the knife holder assemblies positioned proximate a juncture of the adjacent drive shaft sections.

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13. A machine for slitting a metal sheet comprising:

- a frame;
- an upper drive shaft assembly mounted for rotation in the frame;
- a lower drive shaft assembly mounted for rotation in the frame;
- each of the drive shaft assemblies comprising a plurality of drive shaft sections each being releasably coupled to an adjacent drive shaft section for rotation in the frame;
- a spindle projecting axially from each of the drive shaft sections;
- a coupling releasably connecting the spindles on adjacent drive shaft sections together;
- a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;
- a plurality of knife holder assemblies supported by the frame in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;
- a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;
- wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;
- wherein the adjacent drive shaft sections of each drive shaft assembly are adapted to be selectively uncoupled from one another for

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servicing of one of the knife holder assemblies positioned proximate a juncture of the adjacent drive shaft sections; and

a screw operably coupled to at least one of the drive shaft sections;

30 whereupon rotation of the screw axially withdraws the drive shaft section from the adjacent drive shaft section.

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A machine for slitting a metal sheet comprising:

a frame;

an upper drive shaft assembly mounted for rotation in the frame;

a lower drive shaft assembly mounted for rotation in the frame;

5 each of the drive shaft assemblies comprising a plurality of drive shaft sections each being releasably coupled to an adjacent drive shaft section for rotation in the frame;

wherein the adjacent drive shaft sections of each drive shaft

assembly are adapted to be selectively uncoupled from one another for

10 servicing the machine;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the frame in pairs for movement along the drive shaft assemblies such that a first knife

15 holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

20 assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

a knife holder position adjustment system operably coupled to each of the knife holder assemblies for movement of the knife holder assembly along the respective drive shaft assembly; and

a programmable controller operably coupled to the knife holder position adjustment system to position the knife holder assemblies along the respective drive shaft assemblies.

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15. A machine for slitting a metal sheet comprising:
an upper frame;
a lower frame coupled to the upper frame;
an upper drive shaft assembly mounted for rotation in the upper
5 frame;
a lower drive shaft assembly mounted for rotation in the lower
frame;
a drive motor operably coupled to the upper and the lower drive
shaft assemblies for rotation of the drive shaft assemblies;
10 a plurality of knife holder assemblies supported by the upper and
lower frames in pairs for movement along the drive shaft assemblies such that
a first knife holder assembly is supported for movement along the upper drive
shaft assembly and a second knife holder assembly is supported for movement
along the lower drive shaft assembly; and
15 a plurality of rotary knives each being mounted in one of the knife
holder assemblies and driven by one of the upper and lower drive shaft
assemblies;
wherein the knives of the first and second knife holder assemblies
cooperate to slit the metal sheet passing through a nip between the knives of
20 the respective knife holder assemblies;
wherein the upper frame is movable relative to the lower frame to
adjust relative vertical positioning of the knives of the first and second knife
holder assemblies for slitting metal sheets of differing thicknesses.

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16. The machine of claim 15 further comprising:
a frame adjustment mechanism for adjusting relative vertical positioning of the knives of the first and second knife holder assemblies in a direction generally perpendicular to the axes of the drive shaft assemblies.
17. The machine of claim 16 wherein the frame adjustment mechanism further comprises:
a pair of jack screws each mounted between the upper and lower frames.
18. The machine of claim 17 further comprising:
an actuator coupled to each of the jack screws for simultaneous adjustment of the jack screws.
19. The machine of claim 15 wherein movement of the upper frame relative to the lower frame maintains the frames generally parallel relative to each other.
20. The machine of claim 19 wherein the upper frame is pivotally coupled to the lower frame.

21. A machine for slitting a metal sheet comprising:
an upper frame;
a lower frame pivotally coupled to the upper frame;
an upper drive shaft assembly mounted for rotation in the upper
5 frame;
a lower drive shaft assembly mounted for rotation in the lower
frame;
a drive motor operably coupled to the upper and the lower drive
shaft assemblies for rotation of the drive shaft assemblies;
10 a plurality of knife holder assemblies supported by the upper and
lower frames in pairs on the drive shaft assemblies such that a first knife holder
assembly is supported for movement along the upper drive shaft assembly and
a second knife holder assembly is supported for movement along the lower
drive shaft assembly, and
15 a plurality of rotary knives each being mounted in one of the knife
holder assemblies and driven by one of the upper and lower drive shaft
assemblies;
wherein the knives of the first and second knife holder assemblies
cooperate to slit the metal sheet passing through a nip between the knives of
20 the respective knife holder assemblies;
a pair of jack screws each mounted between the upper and lower
frames for adjusting relative vertical positioning of the knives of the first and
second knife holder assemblies in a direction generally perpendicular to the
axes of the drive shaft assemblies for slitting metal sheets of differing
25 thicknesses;

wherein movement of the upper frame relative to the lower frame maintains the frames generally parallel relative to each other; and an actuator coupled to each of the jack screws for simultaneous adjustment of the jack screws.

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22. A machine for slitting a metal sheet comprising:

- an upper frame;
- a lower frame coupled to the upper frame;
- an upper drive shaft assembly mounted for rotation in the upper frame;

a lower drive shaft assembly mounted for rotation in the lower frame:

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

10 a plurality of knife holder assemblies supported by the upper and lower frames in pairs on the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;

15 a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

a knife holder position adjustment system operably coupled to each of the knife holder assemblies for movement of the knife holder assembly along the respective drive shaft assembly; and

a programmable controller operably coupled to the knife holder position adjustment system to position the knife holder assemblies along the respective drive shaft assemblies;

wherein the upper frame is movable relative to the lower frame to
5 adjust relative vertical positioning of the knives of the first and second knife
holder assemblies for slitting metal sheets of differing thicknesses.

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23 A machine for slitting a metal sheet comprising:
an upper frame;
a lower frame coupled to the upper frame;
an upper drive shaft assembly mounted for rotation in the upper
5 frame;
a lower drive shaft assembly mounted for rotation in the lower
frame;
each of the drive shaft assemblies comprising a plurality of drive
shaft sections each being releasably coupled to an adjacent drive shaft section
10 for rotation in the associated frame;
a drive motor operably coupled to the upper and the lower drive
shaft assemblies for rotation of the drive shaft assemblies;
a plurality of knife holder assemblies supported by the upper and
lower frames in pairs supported for movement along the drive shaft assemblies
15 such that a first knife holder assembly is supported for movement along the
upper drive shaft assembly and a second knife holder assembly is supported
for movement along the lower drive shaft assembly;
a plurality of rotary knives each being mounted in one of the knife
holder assemblies and driven by one of the upper and lower drive shaft
20 assemblies;
wherein the knives of the first and second knife holder assemblies
cooperate to slit the metal sheet passing through a nip between the knives of
the respective knife holder assemblies;

wherein the adjacent drive shaft sections of each drive shaft assembly are adapted to be selectively uncoupled from one another for servicing the machine;

wherein the upper frame is movable relative to the lower frame to

5 adjust relative vertical positioning of the knives of the first and second knife holder assemblies for slitting metal sheets of differing thicknesses.

24 A machine for slitting a metal sheet comprising:

an upper frame;

a lower frame coupled to the upper frame;

an upper drive shaft assembly mounted for rotation in the upper

5 frame;

a lower drive shaft assembly mounted for rotation in the lower

frame;

each of the drive shaft assemblies comprising a plurality of drive

shaft sections each being releasably coupled to an adjacent drive shaft section

10 for rotation in the respective frame;

wherein the adjacent drive shaft sections of each drive shaft

assembly are adapted to be selectively uncoupled from one another for

servicing the machine;

a drive motor operably coupled to the upper and the lower drive

15 shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the upper and

lower frames in pairs for movement along the drive shaft assemblies such that

a first knife holder assembly is supported for movement along the upper drive

shaft assembly and a second knife holder assembly is supported for movement

20 along the lower drive shaft assembly;

a plurality of rotary knives each being mounted in one of the knife

holder assemblies and driven by one of the upper and lower drive shaft

assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

5 wherein the upper frame is movable relative to the lower frame to adjust relative vertical positioning of the knives of the first and second drive shaft assemblies for slitting metal sheets of differing thicknesses;

 a knife holder position adjustment system operably coupled to each of the knife holder assemblies for movement of the knife holder assembly along the respective drive shaft assembly; and

10 a programmable controller operably coupled to the knife holder position adjustment system to position the knife holder assemblies along the respective drive shaft assemblies.

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25 A machine for slitting a metal sheet comprising:
a frame;
an upper drive shaft assembly mounted for rotation in the frame;
a lower drive shaft assembly mounted for rotation in the frame;
5 a drive motor operably coupled to the upper and the lower drive
shaft assemblies for rotation of the drive shaft assemblies;
a plurality of knife holder assemblies supported by the frame in
pairs for movement along the drive shaft assemblies such that a first knife
holder assembly is supported for movement along the upper drive shaft
10 assembly and a second knife holder assembly is supported for movement
along the lower drive shaft assembly;
a plurality of rotary knives each being mounted in one of the knife
holder assemblies and driven by one of the upper and lower drive shaft
assemblies;
15 wherein the knives of the first and second knife holder assemblies
cooperate to slit the metal sheet passing through a nip between the knives of
the respective knife holder assemblies;
knife holder position adjustment means for moving each of the
knife holder assemblies along the respective drive shaft assembly; and
20 controller means for controlling the knife holder position
adjustment means.

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26. A machine for slitting a metal sheet comprising:
an upper frame;
a lower frame coupled to the upper frame;
an upper drive shaft assembly mounted for rotation in the upper
5 frame;
a lower drive shaft assembly mounted for rotation in the lower
frame;
a drive motor operably coupled to the upper and the lower drive
shaft assemblies for rotation of the drive shaft assemblies;
10 a plurality of knife holder assemblies supported by the upper and
lower frames in pairs supported for movement along the drive shaft assemblies
such that a first knife holder assembly is supported for movement along the
upper drive shaft assembly and a second knife holder assembly is supported
for movement along the lower drive shaft assembly; and
15 a plurality of rotary knives each being mounted in one of the knife
holder assemblies and driven by one of the upper and lower drive shaft
assemblies;
wherein the knives of the first and second knife holder assemblies
cooperate to slit the metal sheet passing through a nip between the knives of
20 the respective knife holder assemblies;
frame moving means for moving the upper frame relative to the
lower frame to adjust a relative vertical positioning of the knives of the first and
second knife holder assemblies for slitting metal sheets of differing thicknesses.

27. A method of slitting a metal sheet comprising the steps of:
 inputting a first set of parameters of the metal sheet into an
 electronic input device;
 inputting a second set of parameters of mults to be slit from the
5 metal sheet into the electronic input device;
 processing the first and second set of parameters in a computer
 to generate a configuration for a plurality of knife blades; and
 automatically positioning the plurality of knife blades on a slitting
 machine according to the configuration.

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28. A method of servicing a knife holder assembly mounted on a shaft of a slitting machine, the method comprising the steps of:

moving the knife holder assembly toward a juncture between first and second sections of the shaft, the sections of the shaft being generally co-
5 linear with one another during operation of the slitting machine;

moving the first section of the shaft relative to the second section to thereby provide increased access to the knife holder assembly positioned proximate the juncture between the sections;

servicing the knife holder assembly; and

10 moving the first section relative to the second section into an operational arrangement for the slitting machine.

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29. A method of operating a slitting machine to slit metal sheets of differing thicknesses, the method comprising the steps of:

passing a first metal sheet of a first thickness into a nip between a plurality of rotating knife blades driven by generally parallel upper and lower

5 shafts mounted for rotation in upper and lower portions of a machine frame, respectively;

slitting the first metal sheet with the knife blades into a first set of mults;

moving the upper shaft relative to the lower shaft and thereby

10 changing relative vertical positioning of the knives driven by the upper and lower shafts;

wherein the upper shaft remains generally parallel to the lower shaft during the moving of the upper shaft relative to the lower shaft;

passing a second metal sheet of a second thickness into the nip

15 between the knife blades, the second thickness being different than the first thickness; and

slitting the second metal sheet with the knife blades into a second set of mults.